

Calcium and Vitamin D Supplementation in the Outpatient Setting

Background:

- Inconsistent and conflicting advice about calcium and vitamin D supplementation
- Ca deficiency can predispose to osteoporosis, fractures
- Vitamin D can increase calcium absorption. Without vitamin D, only 10-15% of dietary calcium and about 60% of phosphorus absorbed
- Vitamin D3 = cholecalciferol (synthesized in skin by UV B rays, converted to active forms by enzymes in liver and kidney). Vitamin D2 = ergocalciferol (consumed in diet – mainly in form of fatty fish)
- Obesity is associated with vitamin D deficiency, as are fat-malabsorption syndromes, nephrotic syndrome, and those on certain medications (see below)

Key recommendations:

- Recommended dietary intake of Ca for women 19 to 50 and men 19 to 70 = 1000 mg daily
- Women > 50 and men > 70 require 1200 mg daily
- Avoid calcium intake above 2500 mg daily, or greater than 2000 mg day in persons > 50
- Aim for appropriate calcium intake via foods and beverages; consider supplements only when dietary intake is inadequate
- Most common side effects of Ca supplements are constipation, bloating, and occasionally nephrolithiasis (symptoms appear dose dependent, and intake of dietary Ca with lower risk of nephrolithiasis)
- Inconsistent and inconclusive findings regarding increased cardiovascular risk (MI) of calcium supplements
- USPSTF 2013 update: insufficient evidence to assess benefits and harms of daily supplementation with more than 1000 mg calcium (or more than 400 IU of vitamin D) for primary prevention of fractures in noninstitutionalized postmenopausal women. Recommend against routine daily supplementation. Recommend adequate calcium intake for skeletal health but did not address supplementation specifically in those with inadequate dietary intake.
- USPSTF 2013 recommendations:
 - Screen for osteoporosis in women aged 65 years or older and in younger women with increased fracture risk
 - Supplementation with vitamin D indicated to prevent falls in community-dwelling adults aged 65 years or older who are at increased risk for falls because of a history of recent falls or vitamin D deficiency (B level rec)
- Neither IOM or WHO have made recommendations for calcium or vitamin D specifically related to fracture prevention

Calcium:

- Supplements often include calcium carbonate, calcium citrate, and occasionally calcium lactate and calcium gluconate.
 - Calcium carbonate with approx 40% elemental calcium, inexpensive, and available, but more a/w constipation and bloating. Take with meals since gastric acidity required for absorption.
 - Calcium citrate with less elemental calcium (21%) but less bothersome GI symptoms. Can be taken independent of food intake

Vitamin D: recommendations from the Endocrine Society

- Screen for vitamin D deficiency in individuals at risk for deficiency. No recommendation for population screening of those not at risk.
- Vitamin D deficiency defined as 25-hydroxyvitamin D [25(OH)D] level < 20
- Vitamin D insufficiency if level 21 – 29
- To raise blood level > 30 in deficient individuals, requires at least 1500-2000 IU vitamin D daily
- Infants and children 0-1 yr require at least 400 IU/daily; children 1 year and older require at least 600 IU/daily
- Obese children and adults and children on anticonvulsants, glucocorticoids, antifungals, and HAART Rx should have at least 2-3x more vitamin D for their age group
- Vitamin D2 > vitamin D3 for treatment and prevention of vitamin D deficiency
- All adults who are deficient in vitamin D should be treated with 50,000 IU of vitamin D2 or D3 once weekly for 8 weeks, or its equivalent 6000 IU of vitamin D2 or D3 daily to achieve level of 30, followed by maintenance therapy of 1500-2000 IU daily
- Recommend vitamin D supplementation for fall prevention

Table. Institute of Medicine 2011 Recommended Dietary Allowances for Vitamin D and Calcium*

Population	Recommended Daily Dose	
	Vitamin D, IU	Calcium, mg
Women		
Aged 19–50 y	600	1000
Aged 51–70 y	600	1200
Aged >70 y	800	1200
Pregnant women		
Aged <18 y	600	1300
Aged >18 y	600	1000
Breastfeeding women		
Aged <18 y	600	1300
Aged >18 y	600	1000
Men		
Aged 19–50 y	600	1000
Aged 51–70 y	600	1000
Aged >70 y	800	1200

* Data from references 11 and 12.

Table 2. Well-Absorbed Dietary Sources of Calcium.*

Type of Food	Serving Size	Elemental Calcium per Serving mg	Calories per Serving kcal
Dairy products			
Plain low-fat yogurt	8.0 oz	448	154
Low-fat yogurt with fruit	8.0 oz	384	238
Mozzarella, part skim milk	1.5 oz	333	108
Cheddar cheese	1.5 oz	307	171
2% Low-fat milk	1 cup	293	122
Low-fat cottage cheese	1 cup	206	194
Fruits and vegetables			
Calcium-fortified orange juice	6.0 oz	261	88
Raw kale	1 cup	100	33
Raw bok choy	1 cup	74	9
Raw broccoli	1 cup	43	31
Canned fish			
Sardines	3.0 oz	325	177
Pink salmon	3.0 oz	183	110
Grains			
Fortified, ready-to-eat cereals	1 cup	100–1333	100–160
Fortified, cooked oat cereals	1 cup	187	159
Commercially prepared white or wheat bread	1 slice	30–73	69–74

* These foods contain low levels of oxalic and phytic acid. Data are from the National Nutrient Database for Standard Reference of the U.S. Department of Agriculture.⁷

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VITAMIN D AND CALCIUM SUPPLEMENTATION TO PREVENT FRACTURES IN ADULTS CLINICAL SUMMARY OF U.S. PREVENTIVE SERVICES TASK FORCE RECOMMENDATION

Population	Men or premenopausal women	Community-dwelling postmenopausal women at doses of >400 IU of vitamin D ₃ and >1000 mg of calcium	Community-dwelling postmenopausal women at doses of ≤400 IU of vitamin D ₃ and ≤1000 mg of calcium
Recommendation	No recommendation. Grade: I statement	No recommendation. Grade: I statement	Do not supplement. Grade: D

Preventive Medications	<p>Appropriate intake of vitamin D and calcium are essential to overall health. However, there is inadequate evidence to determine the effect of combined vitamin D and calcium supplementation on the incidence of fractures in men or premenopausal women.</p> <p>There is adequate evidence that daily supplementation with 400 IU of vitamin D₃ and 1000 mg of calcium has no effect on the incidence of fractures in postmenopausal women.</p> <p>There is inadequate evidence regarding the effect of higher doses of combined vitamin D and calcium supplementation on fracture incidence in community-dwelling postmenopausal women.</p>		
Balance of Benefits and Harms	Evidence is lacking regarding the benefit of daily vitamin D and calcium supplementation for the primary prevention of fractures, and the balance of benefits and harms cannot be determined.	Evidence is lacking regarding the benefit of daily supplementation with >400 IU of vitamin D ₃ and >1000 mg of calcium for the primary prevention of fractures in postmenopausal women, and the balance of benefits and harms cannot be determined.	Daily supplementation with ≤400 IU of vitamin D ₃ and ≤1000 mg of calcium has no net benefit for the primary prevention of fractures.
Other Relevant USPSTF Recommendations	The USPSTF has made recommendations on screening for osteoporosis and vitamin D supplementation to prevent falls in community-dwelling older adults. These recommendations are available at www.uspreventiveservicestaskforce.org .		

For a summary of the evidence systematically reviewed in making this recommendation, the full recommendation statement, and supporting documents, please go to www.uspreventiveservicestaskforce.org.

References:

- 2011. The Endocrine Society's Clinical Guidelines: Evaluation, Treatment, and Prevention of Vitamin D Deficiency. J Clin Endo and Metab, 96(7): 1911-1930.
- Bauer, D. 2013. Calcium Supplements and Fracture Prevention – Clinical Practice. NEJM, 369 (16): 1537-1543.
- Moyer, V. 2013. Vitamin D and Calcium Supplementation to Prevent Fractures in Adults: U.S. Preventive Services Task Force Recommendation Statement. Ann Int Med, 158(9): 692-696.